APPENDICES

APPENDIX 1

DATA REQUIREMENTS FOR
Malathion

Chemical No:057701

158.490 Wildlife and Aquatic Organisms

Guideline		Data In	MRID(s)	Data Req. Fulfilled
71-1(a)	Acute Avian Oral,Quail/Duck	Yes	00160000	Yes
71-2(a)	Acute Avian Diet, Quail	Yes	00022923	Yes
71-2(b)	Acute Avian Diet, Duck	Yes	00022923	Yes
71-3	Wild Mammal Toxicity	No	Not Required	NA
71-4(a)	Avian Reproduction Quail	Yes	43501501	Yes
71-4(b)	Avian Reproduction Duck	Yes	42782101	Yes
71-5(a)	Simulated Terrestrial Field Study	No	Not Required	NA
71-5(b)	Actual Terrestrial Field Study	No	Not Required	NA
72-1(a)	Acute Fish Toxicity Bluegill	Yes	40098001	Yes
72-1(b)	Acute Fish Toxicity (TEP)	No	Required*(5,6)	No
72-1(c)	Acute Fish Toxicity Rainbow Trout	Yes	40098001	Yes
72-1(d)	Acute Fish Toxicity Rainbow Trout (TEP)	No	Required*(5,6)	No
72-2(a)	Acute Aquatic Invertebrate	Yes	40098001	Yes
72-2(b)	Acute Aquatic Invertebrate (TEP)	Yes	41029701	Partially**
72-3(a)	Acute Est/Mar Toxicity Fish	Yes	41174301	Yes
72-3(b)	Acute Est/Mar Toxicity Mollusk	Yes	40228401	No
72-3(c)	Acute Est/Mar Toxicity Shrimp	Yes	41474501	Yes
72-3(d)	Acute Est/Mar Toxicity Fish (TEP)	Yes	41252101	Partial **(5,6)
72-3(e)	Acute Est/Mar Toxicity Mollusk (TEP)	Yes	42249901	Partial**(5,6)
72-3(f)	Acute Est/Mar Toxicity Shrimp (TEP)	Yes	Required*(5,6)	No
72-4(a)	Early Life Stage Fish(Freshwater)	Yes	41422401	Yes
72-4	Early Life StageEstuarine Fish	Yes	Required*(5,6)	No
72-4(b)	Life Cycle Aquatic Invertebrate	Yes	41718401	Yes
72-5	Life Cycle Fish	Yes	Reserved	No
72-6	Aquatic Organism Accumulation	Yes		

Guideline	Data In	MRID(s)	Data Req. Fulfilled
72-7(1) Simulated Aquatic Field Study	No	Reserved	No
72-7(b) Actual Aquatic Field Study	No	Reserved	No
§158.540 PLANT PROTECTION			
122-1(a) Seed Germ.,Seedling Enmergence	No	Not required	NA
122-2 Aquatic Plant Growth	No	Not required	NA
122-1(a) Seed Germ./Seedling Emerg.	No	Not required	NA
122-1(b) Vegetative Vigor	No	Not required	NA
123-1(a) Seed Germ./Seedling Emerg.	No	Not required	NA
123-1(b) Vegetative Vigor	No	Not required	NA
123-2 Aquatic Plant Growth	No	Not required	NA
124-1 Terrestrial Field Study	No	Not required	NA
124-2 Aquatic Field Study	No	Not required	NA
§158.490 NONTARGET INSECT TESTING			
141-1 Honey Bee Acute Contact	Yes	05001991,001999, 05004151, 05004003	Yes
141-2 Honey Bee Residue on Foliage	Yes	4120800, 41284701	Yes
141-5 Fueld Test for Pollinators	No	Reserved	No

FOOTNOTES:

*Required to support Malathion/Methoxychlor mixture products

**Though formulation tests on 57EC were submitted the Agency requires formulation toxicity testing of Malathion/Methoxychlor mixture products

1. 1=Terrestrial Food; 2=Terrestrial Feed; 3=Terrestrial Non-Food; 4=Aquatic Food; 5=Aquatic Non-Food(Outdoor);6=Aquatic Non-Food (Industrial);7=Aquatic Non-Food (Residential);8=Greenhouse Food; 9=Greenhouse Non-Food;10= Forestry; 11=Residential Outdoor; 12=Indoor Food; 13=Indoor Non-Fo d; 14=Indoor Medicinal;15=Indoor Residential

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Environmental Fate Data Requirements

	Status	MRID Number
Degradation		
161-1 Hydrolysis	Fulfilled	
	(RJM, 12/15/92	40941201
	RJM, this review)	43166301
161-2 Photo. - water	Fulfilled	
	(RJM, 12/15/92	41673001
	RJM, this review)	43166301
161-3 Photo. - soil	Fulfilled	40658009
	(RJM, 12/15/92	41695501
	RJM, this review)	43166301
161-4 Photo. - air	Not required[1]	
	(RJM, 12/15/92	40969301
	RJM, this review)	43166301
Metabolism		
162-1 Aerobic soil	Fulfilled	
	(RJM, 12/15/92	41721701
	RJM, this review)	43163301
162-2 Anaerobic soil	Not required	
162-3 Anaerobic aquatic	Fulfilled	
	(RJM, 12/15/92	42216301
	RJM, this review)	43163301
162-4 Aerobic aquatic	Unfulfilled	
	(RJM, 12/15/92)	42271601
	(RJM, this review)	43163301
Mobility		
163-1 Leaching, Ads./ Desorption	Fulfilled	
	(RJM, 12/15/92)	41345201
	(RJM, this review)	43163301
		43868601
163-2 Volatility-lab	Fulfilled	
	(RJM, 12/15/92)	42015201
163-3 Volatility-field	Not Required[2]	
Dissipation		
164-1 Soil	Fulfilled	
	(HLM, 7/25/91	41748901
	RJM, 12/15/92,	41727701
	this review)	43042401
		43042402
		43166301
164-2 Aquatic	Unfulfilled	

[6]A study was submitted and reviewed but was not acceptable. Based on the laboratory volatility study, volatility does not appear to be an important route of dissipation; therefore, this study is not needed at this time.

	Status	MRID
	(RJM, 12/15/92)	42058401
		42058402
	(RJM, this review)	43166301
164-3 Forest	Not required	

	Status	**MRID**
164-5 Soil, long term	Not required	

Accumulation

165-2 Field rotat. crop	Not required	
165-3 Irrigated crop	Fulfilled	
	(RJM, 12/15/92)	42058401
		42058402
	(RJM, this review)	43166301
165-4 Fish	Fulfilled	
	(RJM, this review)	43106401
		43106402
		43340301

Spray Drift

201-1 Drop size spec.	Not submitted[3]
202-1 Drift field eval.	Not submitted

[3] Data is not required at this time pending the results of the spray drift task force.

APPENDIX 2

Tier I Estimated Concentrations for Surface-Water Exposure Assessment

Summary

Based on fate characteristics, model predictions and actual monitoring studies, the Agency predicts malathion will reach drinking water sources from the proposed uses. Surface water concentrations were modeled using the GENEEC model with acute and chronic drinking water levels set with the pesticide use scenarios that produced the highest aqueous pesticide levels. HED has indicated that malathion's degradate, malaoxon, is to be included in the tolerance expression for malathion thus water concentrations are provided in this document for both malathion and, when possible, malaoxon.

Table 1. Expected drinking water concentrations for malathion and malaoxon (Tier I).

compound / exposure type	surface water		ground water	
	estimated concentration (ppb)	source of concentration	estimated concentration (ppb)	source of concentration
malathion / acute	226	GENEEC peak	3.1	Monitoring data
malathion / chronic	21.2	GENEEC 56-day ave.		
malaoxon / acute	96.0	GENEEC peak	3.1	Derived from malathion monitoring data
malaoxon / chronic	75.5	GENEEC 56-day ave.		

EFED recommends that 226 and 96.0 ppb (Table 1) be considered as the highly conservative first tier estimates for acute surface drinking water levels for malathion and malaoxon, respectively. For chronic surface drinking water levels, 21.2 and 75.5 ppb are recommended for malathion and malaoxon, respectively. The chronic malaoxon value exceeds the chronic malathion level because of its longer expected environmental persistence. First tier groundwater concentrations were derived from monitoring data because they were higher than results from the SCIGROW model. The highest detected malathion concentration in groundwater accepted by EFED was 3.1 ppb. Malaoxon was not examined in this study but the same value is expected to be a conservative estimate of malaoxon concentration. EFED recommends exposure estimates of 3.1 ppb for malathion and 3.1 ppb for malaoxon in ground water.

This assessment was conducted under guidelines stated in OPP's Interim Approach for Addressing Drinking Water Exposure (November 1997), however, standard modeling techniques were modified to estimate malaoxon concentrations. Malaoxon levels were estimated with the GENEEC model with the ***assumption*** that fate variables which were not known are the same as those for malathion. Acceptable environmental fate studies specifically for malaoxon; including degradation, metabolism, mobility, dissipation, and solubility data; would be very useful for future assessments.

Environmental Fate

Based on all the data submitted, EFED concludes that the primary route of dissipation of malathion in surface soils appears to be aerobic soil metabolism. Supplemental data submitted by the registrant shows malathion degrades in soils with a half-life ($_{T1/2}$) of <1 day on Blackoar loam soil (pH 6.1). For modeling this half-life value was multiplied by a factor of three to estimate a 90th percentile $t_{1/2}$ value, thus a 3-day half-life was used. This half-life is the same as the value used by USDA in malathion modeling (USDA 1991). EFED notes that longer half-lives (6.9 days) have been reported on sand (CalEPA 1996). Laboratory half-lives for anaerobic aquatic metabolism (<2.5 days) and hydrolysis (6.21 days at pH 7, 12 hours at pH9) indicate that these are also important routes of dissipation. Conversely, the compound is moderately stable to aqueous ($t_{1/2}$ = 71 and 98 days) and soil photolysis ($t_{1/2}$ = 173 days) and does not volatilize appreciably ($\leq$ 5.1% volatilized after 16 days).

Data presented to the Agency demonstrate that malathion is extremely mobile and thus runoff and leaching may be major routes of dissipation. Acceptable leaching data on parent malathion indicate that it is mobile in all soils tested [K_ds = 0.82-2.47 L/kg, K_{oc}s =151-308 L/kg]. Terrestrial and aquatic field dissipation data indicate rapid dissipation ($t_{1/2}$ = <2 days). Malathion has been detected in ground water in three states at levels ranging from 0.007 to 6.17 ppb (USEPA 1992). Based on these data, EFED concludes that malathion has the potential to contaminate surface and ground water.

Malathion mono- and dicarboxylic acids, malaoxon, ethyl hydrogen fumarate, diethyl thiosuccinate, and CO_2 are degradates that have been found in malathion laboratory and field studies. Time course studies on malaoxon production on sand and soil have been published (CalEPA 1993) showing levels to increase over time. Maximal measured malaoxon concentration relative to initial malathion concentrations were 1.4% (after ~10 days on sand) and 10.7% (after 21 days on soil). Measurements past 21 days were not made. In the aerobic soil metabolism study submitted by the registrant 1.8% conversion to malaoxon was the maximum level observed on the Blackoar loam soil, thus 10.7% conversion appears to be a conservative conversion value.

EFED does not have a complete environmental fate database for malaoxon but based on its chemical similarity to malathion (sulfur is replaced by oxygen); the parent and its degradate are expected to have similar chemical properties. However, the biological properties of malaoxon are notably different in th it is more toxic than malathion. The aerobic half-life of malaoxon has been reported as 3 and 7 days in basic and acidic soils, respectively (Paschal and Neville 1976). This longer half-life is proposed to be result of malaoxon's biocidal effect on soil microbes which contribute to malathion's degradation.

Surface Water Assessment

GENEEC (USEPA 1995) is a screening model designed by the Environmental Fate and Effects Division (EFED) to estimate the concentrations found in surface water for use in ecological risk assessment. As such, it provides upper-bound values on the concentrations that might be found in ecologically sensitive environments because of the use of a pesticide. It was designed to be simple and require data which is typically available early in the pesticide registration process. GENEEC is a single event model (one runoff event), but can account for spray drift from multiple applications. GENEEC is hardwired to represent a 10-hectare field immediately adjacent to a 1-hectare pond that is 2 meters deep with no outlet. The pond receives a spray drift event from each application plus one runoff event.

The runoff event moves a maximum of 10% of the applied pesticide into the pond. This amount can be reduced due to degradation on the field and the effects of soil binding in the field. Spray drift is equal t 1 and 5% of the applied rate for ground and aerial spray application, respectively.

Standard GENEEC modeling is inappropriate for malaoxon concentrations because the model assumes initial concentrations are highest which is not the case with malaoxon which increases over a period of weeks. In this case EFED chose a conservative scenario for modeling malaoxon concentrations by assuming that 10.7% of each malathion application is converted to malaoxon, thus for the purposes of GENEEC malaoxon was applied at 10.7% the rate of malathion. Data used for modeling were not ideal. The physical parameters used for malaoxon were those of malathion based on their chemical similarity. For the purpose of modeling EFED has attempted to estimate the upper 90^{th} percentile of malaoxon's aerobic soil half-life value by multiplying 7 days (Paschal and Neville 1976) by a factor of three resulting in the model input value of 21 days. The aqueous half-life used was 107 days (based on malathion hydrolysis at pH 5), respectively. Both half-lives are expected to be conservative. The hydrolysis data for malathion is expected to be similar to malaoxon and is used in the absence of a half-life value in water with microbial activity.

Modeling results indicate that malathion and malaoxon have the potential to move into surface waters. Based on the inputs shown in Table 2 the peak GENEEC estimated environmental concentrations (EEC) of malathion and malaoxon in surface water is 226 and 96.0 ppb, respectively (Table 3). This estimate is based on the maximum application rate for citrus which represents the highest application rate for any crop used to support residue tolerances. EFED notes that higher use rates are reported on product labels but the registrant has stated they will not support rates greater than those defined in crop residue studies.

Acute exposure

EFED recommends that 226 and 96.0 ppb be adopted as a highly conservative estimates of *acute* first tier drinking-water exposure for malathion and malaoxon, respectively, based on the peak GENEEC value obtained with use on citrus and cotton.

Chronic exposure

EFED recommends that 21.2 and 75.5 ppb be adopted as highly conservative first tier estimates of *chronic* drinking-water exposure for malathion and malaoxon, respectively, based on 56-day average GENEEC concentrations obtained with use on citrus and cotton.

Table 2. GENEEC Environmental Fate Input Parameters (values are for malathion unless otherwise stated.)

DATA INPUT	INPUT VALUE	DATA ASSESSMENT	SOURCE
Application Rate	0.18-6.25 lbs ai/A	confirmed	Recommended usage rates
Maximum Number of Applications	1-25	confirmed	Recommended usage rates
Application Interval	3-30 days	confirmed	Recommended usage rates
Batch Equilibrium (Koc)	151 ml/g	Acceptable	MRID 41345201
Aerobic Soil Metabolism	malathion: $t_{1/2}$ = 3 day malaoxon: $t_{1/2}$ = 3-7 day (model input = 21 days)	Supplemental Supplemental	MRID 41721701 Paschal and Neville 1976
Solubility	145 ppm	Acceptable	Reported by registrant
Aerobic Aquatic Metabolism	$t_{1/2}$= 3.3 day	Acceptable	MRID 42271601, 43163301
Hydrolysis (used for malaoxon aerobic aquatic $t_{1/2}$)	$t_{1/2}$= 104 day		MRID 40941201
Photolysis	$t_{1/2}$ = 94 days	Acceptable	MRID 41673001, 43166301

Table 3. GENEEC EECs (µg/L) for certain malathion uses. The lowest and highest malathion use-rates and the use scenario for cotton were analyzed by GENEEC modeling.

rate (lbs ai / A)	crop / interval (days)	application		GENEEC EEC (µg/L)			
				malathion		malaoxon	
		method	max # annually	peak	56-day ave	peak	56-day ave
0.18	Orange/7 grapefruit/7 lemon/7 lime/7 tangerine/7 tangelo/7 kumquat/7	aerial	10	8.24	0.78	3.10	2.44
0.50	Flax	ground	1	11.4	1.07	1.82	1.43
2.5	Cotton/3	ground	25	181	16.9	96.0	75.5
5.0	Pineapple/7	ground	3	224	20.9	47.3	37.2
5.0	Chestnut/7	ground	4	225	21.1	57.1	44.9

6.25	Orange/30 grapefruit/30 lemon/30 lime/30 tangerine/30 tangelo/30	ground	3	226	21.2	37.1	29.2

EFED notes that there is limited information available on the conversion of malathion to malaoxon during drinking water treatment. In a limited sampling of water entering and leaving a water treatment plant both malathion and malaoxon levels generally decreased after treatment, however, one sample showed an increase in malaoxon (USDA 1997). Data from sampling and analysis with a lower detection limit show a much higher rate of conversion (summarized further in the second tier assessme and Table _)(personal communication, Dr. Marion Fuller, Florida Department of Agriculture and Consumer Services). EFED recognizes that conversion of malathion to malaoxon may be more efficient during water treatment than under conditions in the field, thus malaoxon may be present at a much higher concentration relative to malathion after water processing.

Ground Water Assessment

As EFED noted above, malathion has some mobility characteristics similar to other chemicals that have been detected in ground water. In addition, malathion has been detected in ground water in at levels ranging from 0.03 to 6.17 ppb in California (1 detection out of 499 wells sampled at a concentration c 0.32 ppb), Mississippi (2 detection out of 263 wells sampled at a range of concentrations of 0.03-0.053 ppb) and Virginia (9 detections out of 138 well sampled at a range of concentration of 0.007-6.17 ppb); as reported in the EPA/OPP/EFED/EFGWB EPA Pesticides in Ground Water Data Base 1971-1991, National Summary. ERB1/EFED believes that malathion has the potential for movement into groundwater, especially on soils with low organic matter and high sand content.

Cheminova disputes the ground-water data reported in the PGWDB. In particular, it calls into question the analytical methods used to generate the data in the Virginia study. In addition, Cheminova indicates that the maximum detection in the study was 3.12 ppb, not 6.17 ppb. Noting Cheminova's doubts for the Virginia data, EFED suggests a ground-water concentration estimate of 3.1 ppb for malathion. This value is more conservative than SCI-GROW modeling results using use parameters for citrus or cotton as stated above. Since this monitoring result is specific for malathion EFED assumes the concentration of malaoxon will not exceed the concentrarion of malathion. Thus, EFED suggests conservative ground water concentration estimates of 3.1 ppb for malathion and 3.1 ppb for malaoxon.

APPENDIX 3

PRZM-EXAMS inputs

Chemical-Specific Input

Persistence and mobility numbers used in the first-tier GENEEC simulations were also used for the Ti II assessment. Chemical specific input parameters for PRZM and EXAMS are summarized in Tables X and .x. Certain assumptions were made for chemical dissipation parameters included in PRZM 3.1 but not GENEEC;

1. The aerobic soil-metabolism half-life of 3 days (see following discussion) was used for the adsorbe and dissolved half-life throughout the soil column. Subsoil layers were assumed not to be anaerobic, as the deepest soil column simulated was only 150 cm deep;

2. A foliar decay rate of 0.126 d^{-1} was used based on the 90% upper confidence limit of 37 foliar halflives reported in Willis and McDowell (1987).

3. Volatilization from the soil or foliage were not simulated (set to zero). Registrant submitted data suggest that volatilization is not an important route of dissipation;

4. Dissipation through plant uptake was not simulated;

5. Foliar wash-off of 0.5 cm^{-1} was simulated, although data exists showing complete wash-off of organophosphate pesticides with the first 0.1 cm of rainfall.

6. An application efficiency of 95% was assumed for all application methods. As for GENEEC, drift from aerial applications was assumed to be 5% of the applied mass of malathion, and that from ground or airblast applications was assumed to be 1% of the applied mass.

The aerobic soil halflife for malathion chosen for modeling purposes was 3 days. This value is consistent with that used for USDA modeling in for malathion in the boll weevil eradication program which is the single greatest consumer of malathion. Degradation rates in soils vary greatly from the registrant supported halflife of 0.2 days to 11 days in rangeland soil with low organic content.[4] Open literature values are mostly greater than those observed in the acceptable submitted aerobic soil metabolism study. However, because the conditions and parameters controlled in the different open literature studies vary greatly it is not possible to calculate an upper 90th percentile limit of the values. In this instance, multiplying the registrant's submitted halflife value of 0.2 days by three to estimate the 90th percentile upper confidence limit did not produce a conservative value relative to published literature (Table 3). Using a single halflife value for modeling multiple scenarios is clearly a simplific

[4] Buckman , H.O. and Brady, N.C., 1969. The Nature and Properties of Soils. Macmillian Company, Collier-Macmillian Limited, London as referrenced in USDA/APHIS National Boll Weevil Cooperative Control Program. Final Environmental Impact Statement Volume 1, 1991.

in this instance but it is necessary to choose a value that is a conservative estimate of malathion degradation in agricultural settings used in modeling. The 3 day halflife chosen is not the highest available value published but conditions favoring very long persistence (*ie* very low moisture levels and micobial counts) are not expected to commonly occur in agricultural settings.

PRZM and EXAMS require that degradation halflives be converted into rate constants. The aerobic soil metabolism half-life of 3 days (as explained above) was converted to a daily rate constant for PRZM 3.1 by the equation Ln 2/($T_{1/2}$). The aerobic aquatic (input variable KBACW), anaerobic aquatic (KABCS), and photolysis (KDP) half-lives for EXAMS were converted to hourly rate constants using the formula Ln 2/($T_{1/2}$ x 24). Hydrolysis half-lives at pH 7(KNH) and pH9 (KBH) were converted to rate constants by solving two simultaneous equations with the stable pH5 (KAH) constant set to zero.

Table 3. PRZM 3.1 input parameters for Malathion

Input Parameter	Value	Quality of Data
Foliar Volatilization (PLVKRT)	0 d^{-1}	Poor
Foliar Decay Rate (PLDKRT)	0.126 d^{-1}	Supplemental
Foliar Wash-off Extraction Coefficient (FEXTRC)	0.5 cm^{-1}	Poor
Plant Uptake Fraction (UPTKF)	0	Poor
Partition Coefficient (Koc) for all crops	151 L kg^{-1}	Acceptable
Dissolved Phase Decay Rate: All Horizons (DWRATE)	0.231 d^{-1}	Fair
Adsorbed Phase Decay Rate: All Horizons (DSRATE)	0.231 d^{-1}	Fair
Vapor Phase Decay Rate (DGRATE) (all horizons)	0 d^{-1}	Poor

Table 4. EXAMS Input parameters for Malathion.

Input Parameter	Value
Aerobic Aqueous Metabolism Constant (KBACW)	8.82 x 10^{-3} h^{-1}
Sediment Metabolism Constant (KBACS)	3.78 x 10^{-3} h^{-1}
Acid Hydrolysis Rate Constant (KAH)	0 h^{-1}
Neutral Hydrolysis Rate Constant (KNH)	4.10 x 10^{-3} h^{-1}
Alkaline Hydrolysis Rate Constant (KBH)	5.46 x 10^{3} h^{-1}
Photolysis Rate Constant (KDP)	2.95 x 10^{-4} h^{-1}
Partition Coefficient (KOC) for all modeled crops	151
Molecular Mass (MWT)	330 g $\cdot mol^{-1}$
Solubility (SOL)	145 ppm
Henry's Law Constant (HENRY)	0
Q10 For The water Column (QTBAW)	2

Q10 For Sediment (QTBAS)	2

Crop-Specific Inputs

Cotton

This input file was adapted from EFED's standard PRZM scenario for cotton grown on the Loring silt loam in Mississippi, dated April 10, 1998. This soil is located in Major Land Use Area (MLRA) 134. However, weather data from Major Land Resource Area (MLRA) 131 is suggested for this standard scenario, as it represents a closer weather station (Jackson, MS). Inputted modeling parameters are as follows:

Crop	Planting Dates	Harvest Dates	Application Dates	Application Method
Cotton	May 1	Sept. 22	June 1 - August 12	Aerial

Local dates for planting and harvesting cotton, and likely dates of malathion application, were from USDA Boll Weevil Eradication reports. This PRZM simulation reflects the maximum label rate (2.5 lb ai/a), number of applications (25/year) and application interval (3 days) sought by the registrants for methyl parathion on cotton. USDA notes that these usage parameters are extreme and only 2 of 1000 fields treated in the Boll Weevil Eradication Program received 25 applications. Quantitative usage statistics show the average application rate of malathion on cotton is 0.3 lbs ai / A.

Sorghum

This input file was adapted from EFED's standard PRZM scenario for sorghum in Kansas grown on a Loring silt loam soil. The weather recorded for MLRA 112 was used for meteorological input. Leroy Brooks of Kansas Agricultural Extension provided information that malathion would be most likely used early in the season to control aphids and greenbugs. Typical application months would be May through July. Inputted modeling parameters are as follows:

Crop	Planting Dates	Harvest Dates	Application Dates	Application Method
Sorghum	May 21	October 1	June 1-15	aerial

Apple

Malathion is used in orchards in the Northwest including apples, cherries, pears and walnuts. The largest use is on cherries and apples but results from these scenarios are expected to similar to each other and other orchard crops. Franz Needleholter of Oregon State Agricultural Extension provided typical malathion application dates for northern Oregon cherries. Applications may begin in the end of May and typically end the beginning of August. The most intense period of malathion usage is in June. Inputted modeling parameters are as follows:

Crop	Bloom	Harvest Dates	Application Dates	Application Method
Apples	April 1	December 15	June 1-29	air blast

Citrus

A standard Florida citrus scenario was chosen to model malathion on this crop. Although more malathion is used annually in California it is expected that the Florida scenario would result in higher estimated environmental concentration because of the weather, agricultural practices, and soils. Andy Rose of the University of Florida Agricultural Extension provided information that insecticides may be used throughout the year in citrus agricultural but use may be highest in the summer months. Modeling parameters were as follows:

Crop	Bloom	Harvest Dates	Application Dates	Application Method
Citrus	May 11	August 1	June 1 - July 31	air blast

Lettuce

More than 14 California vegetable crops receive malathion treatments. The California lettuce scenario adapted from a cole crop scenario is expected to have similar results to several other California crops. Dr. Bill Chaney in Salinas with Agricultural Extension provided very useful information on lettuce grow in central California. Lettuce may be planted anytime from January through August and harvested anytime from April through November. No lettuce is grown in December to break lettuce mosaic virus life cycle. Insecticides are applied generally starting April 1. Modeling parameters were as follows:

Crop	Planting Dates	Harvest Dates	Application Dates	Application Method
Lettuce	February 10	May 12	April 1-26	aerial

APPENDIX 4

Other Aquatic Monitoring Studies

Environmental Monitoring for Malathion Residues in Selected APHIS (PPQ) Control/Eradication Programs. USDA, 1990.

(A) Florida Medfly Program
Methods: Water analysis of residue levels in canals, lakes, swimming pools located with 1/4 miles of spray sites in Florida. Samples were taken 24 hours prior to and immediately after malathion sprays (15 minutes) - 1985 - 24 samples taken. 1987 - 42 water samples. 1990 - 62 water samples taken.

Results: 15 minutes post application
1985 - 6 of 24 samples showed Malathion residues 0.2 - 2 ppb
1987 - 9 of 42 samples - Residue levels - 0.23 - 1.55 ppb
1990 - 56 of 62 samples Residue levels - mean 0.8 ppb 0.23 - 51 ppb
mean average fluctuation 6 - 18 ppb - mean 9.4 ppb

After 48 hours residues degraded rapidly - most below detectable limits.

(B) Grasshopper Control Programs

These monitoring programs were conducted in 13 states from 1984 through 1989.

Methods: Malathion applied at 8 oz ULV/Acre; Purity was 91% ai. Samples obtained from flowing or impounded waters, natural or man made and standing water within 1/4 mile of spray zone or in the spray zone. Samples collected 24 hours prior to application and 15 minutes after application. Some sites - daily sample up to 72 hours post application. Level of detection = 0.1 ppb.

Results: Residue ranges were from 0.11 to 85.11 ppb - Highest residues in Utah and Wyoming. Two day samples had residues of 0.3 - 18 PPB.

© Bollweevil Control Program: Monitoring was conducted in Alabama, Arizona, California, Florida, Georgia, New Mexico, Mississippi, N. Carolina, So. Carolina and Texas during the 1985, 1988, 1989 and 1990 cotton growth seasons.

Methods: Application rate was 12 oz./Acre of 93-96% malathion using ULV. Interval was as little as one week for multiple applications. Soil, water and vegetation samples were collected. Water samples were take from area within 1/4 mile of application sites. These included recreational areas, houses, buildings, endangered species habitat, cotton fields (multi-applications) and pond sample following rainfall which occurred 3 days post-app. Where runoff occurred daily samples were collected for 3-5 days depending on how soon after application rainfall occurred.

Results: In Alabama 48 of 82 samples had Malathion residues over 0.1 ppb. These ranged from 0.102 to 24.74 ppb. Only 1 site was over 20 ppb (all samples). In Florida 15 samples were taken with 8 having residues ranging from 6 to 48.6 PPB (the high Malathion residues less than 6 PPB. In Georgia post application mean average residues after 12 applications were 12.9 PPB (15 minutes), 5.18 PPB (1-5 days) 1.78 PPB (6-10 days) and 1.86 (11-71 days.) Testing to determine whether distance or amount of rainfall was a more important factor indicated that distance from the water was more influential in effecting residue levels.

Pesticide Residues in Hale County, Texas, Before and After Ultra-Low Volume Aerial Application of Malathion. Guerrant, G.O. et al Pesticides Monitoring Journal, 1970.
Methods: Mosquito control June - August 1967 near Plainview and Abernathy Texas. Applied at 3.0 fluid oz/Acre by Air Force Tactical Air Command C 123 cargo planes based with 4500th Air Base Wing in Langley, AFB, Va. Altitude: 150 feet. Speed 150 mph. Winds <10 mph. Filter papers used to collect residues.

Results: Average concentration following 20 applications on June 16-22 was 1.5 MG/FT^2 or 65% of application rate. Hydrolysis studies of water samples stored in various PH solutions up to 20 days after treatment showed residue stability at pH 2 and 72-62% recovery in pH 4-6. At pH 7 and 8, 16% and 11% recovery were observed. Residues in 32 sites (field water) showed malathion residues of 0.00 to 0.50 ppm 4 hours post application which decreased to < 0.006 within 24 hours post application.

Residue Monitoring Report submitted to the Agency as 6a2 information under Barcode D207975.

Methods: Surface water residue monitoring data from waters adjacent to California rice fields included bensulfuron methyl, molinate, thiobencarb, carbofuran, methyl parathion, and malathion monitoring results.

Results: For malathion the maximum reported residues were 0.17 ppb.

Malathion: Special Projects Report No. 84-9SP. Cornacchia, John W., 1984. A report to the California State Water Resources Control Board, Toxic Substances Control Program.
This report not only summarizes fate and toxicity characteristics for the Board, but also reports on findings of the 1981 monitoring program carried out during Medfly eradication efforts in Santa Clara, Santa Cruz, and San Mateo counties.

Spray Methods: Aerial spraying during spring, summer and fall months. 6 or more applications were made per site at a rate of 2.4 oz. Cythion/acre as a malathion laced bait. Helicopter and fixed wing aircraft were used.

Monitoring Program Methods: Monitoring stations were concentrated in aquatic areas based on the value of fisheries resources supported by the watershed. Creeks and rivers were sampled 24 hours prior to spraying to establish background levels of contaminants. Post application samples were taken within 72 hours of spraying in the area. These sample scenarios were taken every 1-2 weeks during the spraying program. Some sediment and biota samples were also taken for analysis of malathion/malaoxon residues. Some of the creeks were sampled daily. Fish kills were monitored mor closely and fish tissues were analyzed as well as the water from the location of the kill. Population estimates were also made before and after spraying in the San Lorenzo River drainage area. Additional monitoring of storm water drains and urban creeks was conducted immediately following rainfall event during the spraying program. The spray zones ranged in size from 43 to 1264 square miles.

Brief Summary of Results:
Santa Clara Valley: Air samples following the spraying did not exceed 1 ug/m^3. Average coverage efficiency was approximately 76% with an estimated 24% loss attributed to off target spray drift. Monitoring was carried out up through the 6th application only. Dissipation from teflon coated collection surfaces indicated a half-life of 2.96 days for malathion residues. Peak summer water samp residue levels in two creeks ranged from 0 to 152 ppb. Based on sampling efforts aquatic half lives from local creeks were calculated to range from 1.71 to 6.97 days with less than 5% remaining after 1 week. One creek actually showed a slight increase in residue levels following applications 3, 4, and 5. During fall spraying efforts more frequent rainfall events led to levels as high as 800 ppb in Adobe Creek. This sample level coincided with a fish kill in the creek. In one instance a spraying effort was continued during a rain event and sampling showed residue levels as high as 1000 ppb, also leading to a fish kill. In general fall monitoring of residue levels averaging below 30 ppb within 48 hours after spraying. Levels were elevated when rain events occurred as late as 6 days after application. Storm drains acted as point source discharges for concentrated residues into tributaries.

The first fish kill primarily involved sticklebacks, a sensitive creek species. Residue levels at the time the kill were 81 ppb. Body tissue concentrations of 3.8 to 1.6 mg/Kg were measured. One sediment sample contained 21 ug/L of malathion, but all others fell below 10 ug/L. In one instance residue levels reached 15 ppb in a lagoon and estuarine trough receiving water from spray area tributaries after a storm event and a fish kill involving striped bass and starry flounders was recorded.

Santa Cruz County: Spraying was carried out from August to mid November. Sampling along the San Lorenzo River and it's tributaries produced residue levels of <0.1 ppb to 41 ppb. Half-life estimates based on these sample periods ranged from 1.67-3.67 days. In general, levels dropped to below 1.0 ppb within a week after application. Rainfall events within 36-72 hours after spraying produced 11 to 19% increases in recorded malathion residues.

San Mateo County: During a storm event malathion residues reached 103 ppb in Pascadero Creek. steelhead trout and stickleback fish kills were reported following the event.

Malathion Residue Detections in Field Studies for Mosquito Control Uses

Description/Location	Application Data	Detected Residue Range

NW Florida near Pensacola Beach, Tagatz, M.E. et al, 1974 Mosquito News test site was saltmarsh plot measuring 85 x 115 ft and control site was similar size. A 10' wide 4' deep canal bordered marsh.	Thermal Fog-95% Technical in fuel oil-applied at 17500 cu. Ft/minute-applied 3 times with two week intervals at low tide.	Marshwater 6 hrs post applic.=5.2 ppb 12 hrs post applic.=<0.1 ppb Canal Water 6 hrs post applic.=0.42 ppb 12 hrs post applic.=<0.1 ppb
Same study as above but applied to different sites=8.5 acre marsh -25 liter tubs also distributed in marsh	ULV application- 3 applications-truck mounted-330 foot swath at rate of 0.64 fl. oz./acre.	After 3rd application: Tubwater:1 hr.=0.32 -1.52 ppb 6 hr=>0.5 - 0.58 ppb Marshwater: <0.05 ppb(ND)
Texas-near West Galveston. Conte F.S. and and J.C. Parker, 1975-applied to 3 bayous and saline lake in a saltmarsh. Depth was 61-91 cm.	Aerial application at 85.7 g/hectare-airspeed 145 km/hr at 9.2 meter altitude.	Post application residues Test I Test II and III 9 hrs:3.0 ppb 1 hr:2.0 - 2.5 ppb 24 hrs: 1.5 ppb 3 hr.: 2.0 - 3.2 ppb 33 hrs: 1.0 ppb 8 hr.: 1.5 - 2.4 ppb 48 hrs: 0.8 ppb 24 hr: 1.2 - 2.2 ppb
Texas-Galveston, Proctor, R.R. J.P. Corliss, and D.V. Lightner, NMFS, Gulf Coastal Fisheries Center	Aerial application at 77.8 ml of 95% malathion/acre. Tests were conducted twice at different times for same test site-two weeks apart.	Measured residues post application Test 1- High tide Test 2 Low Tide 0 hr= 8.9 ppb 65.3 ppb 6 hr=7.0 ppb 69.0 ppb 24 hr=3.1 ppb 1.08 ppb 48 hr=0.5 ppb 0.05 ppb

During the 1981 aerial application program to control medfly outbreaks the California Dept. Fish and Game documented the environmental effects of malathion laced protein bait applications on 23 inland streams during the first 10 spray sequences of the program. Application rate was 196 g/ha. First application was July 14, 1981. One liter samples were collected in amber glass bottles at 0.3 m. depth, closed under water(to prevent air pockets), placed on ice, chilled to 4 deg. C, and transported to the Dept. Of Food and Agriculture's Meadowview laboratory in Sacramento for analysis of malathion residues. Samples were taken within 24 hours before application or within 12 hours after application.

"The aerial applications produced noticeable pulses of malathion concentrations in the streams. The peak malathion concentrations generally diminished to previous pre-spray concentrations before the next application."

" The highest malathion concentrations recorded in streams were those during or immediately followin rainstorms. On October 7, 1981, 800 ug/L malathion was recorded at Station 4.1 during a major rainstorm. In Stevens Creek (Station 8.2), the effect of rain runoff on malathion concentrations was dramatic; previously recorded post-spray levels averaged 4.4 ug/liter but increased to 159 ug/liter on October 27, 1981 immediately after a rainstorm. High concentrations of malaoxon were also seen in these water samples. At station 4.5A, malaoxon concentrations exceeded the malathion concentrations."

San Francisco Monitoring Program-Stream Samples Mean Monitored Levels in PPB

Station # and Location	Dates Monitored	Pre Application Mean(range)	Post application Mean(range)
1.1 Permanente Creek	7/14-8/10	0.3(0.2-0.5)	8.3(0.7-19.0)
1.2 Stevens Creek(El Camino)	7/14-8/9	2.9(1.7-4.0)	40.9(0-82.6)
2.1 Saratoga Creek	7/16-8/9	0	0.2(0.2-0.2)
3.1 San Tomas Aquino Creek	7/15-8/27	2.2(0.9-5.1)	57.4(0.3-157.0)
4.1 Los Gatos Creek	7/16-8/5	0.5(0-1.3)	2.5(0.6-5.4
4.2 Ross Creek	7/16-8/5	2.2(0.1-4.3	27.1(6.2-50)
4.3 Coyote Creek(Oakland Rd)	7/16-8/26	0.8(0.2-2.1)	3.1(0.4-10)
5.1 Coyote Creek(Kelly Park)	7/15-8/6	0.4(0.2-0.6)	1.0(0.3-1.6)
7.1 Belmont Creek	8/11-9/16	0.4(0.2-0.6)	20.1(2.8-81.1)
8.1 Adobe Creek	7/15-8/6	1.5(0-4.3)	19.6(1.0-54.0)
8.2 Stevens Creek(S.Creek Blvd)	7/15-9/24	0.3(0-1.5)	4.1(1.2-8.8)
8.3 Los Trancos Creek	7/19-8/26	0.1(0-0.2)	2.5(0.7-5.3)
10.1 Llagas Creek	8/13-9/22	0.3(0-0.5)	1.3(0-3.8)
10.2 Uvas Creek	8/13-9/22	0.5(0-1.4)	1.1(0-2.6)
12.1 San Lorenzo River(Felton)	8/15-9/22	0.3(0-0.5)	6.2(0-15.9)
12.2 San Lorenzo R. (Brookdale)	8/15-9/21	0.2(0.1-0.3)	6.4(0.7-17.0)
12.3 Loch Lomond Reservoir	8/24-9/21	0.1(0-0.1)	4.2(0.1-12.5)
12.4 Bear Creek	8/15-9/22	0.3(0.2-0.4)	12.5(1.0-39.0)
12.5 Boulder Creek	8/15-9/21	0.1(0-0.3)	10.2(0.2-41.0)
12.6 San Lorenzo R.(Saratoga Rd)	8/15-9/21	0.1(0-1.4)	0.3(0-0.6)
13.1 Coyote Creek(Metcalf Rd)	8/12-9/24	0(0-0.3)	0.5(0.1-1.0)
15.1 Alameda Creek	8/27-9/25	0.1(0-0.3)	1.6(0.4-2.9)
16.1 Pajaro River(Hwy 101)	9/1-9/24	0.7(0.4-1.1)	5.6(0.3-11.5)

Malathion /Malaoxon Concentrations Up and Down Stream of 4 Drainage Culverts

Station #	**October 27 Malathion/Malaoxon ug/L**	**November 12 Malathion/Malaoxon ug/L**
1.3A Upstream At Drain Downstream	449.5 / 164.5 569 / 384 361.5 / 169	328.2 / 30.4 231.2 / 21.2 253.2 / 22.1

4.4 A Upstream At Drain Downstream	2.0 / 0.8 142 / 147 23.5 / 22	38.6 / 26 37.5 / 13.5 37.9 / 26.9
4.5 A Upstream At Drain Downstream	137 / 212.5 188.5 / 250 169.5 / 231	32.0 / 18.4 50.0 / 13.8 37.3 / 19.3
1.5 A Upstream At Drain Downstream	159.0/ 68.0 434.0 / 166.5 156.5 / 68.0	52.3 / 14.8 292 / 57.5 62.5 / 14.8

Six different locations(sampling stations) in the San Francisco Bay estuary were monitored during the 1981 medfly eradication program. The samples represented prespray levels, levels after spraying during the dry season(July 15-Sept. 24), and during the rainy season Oct. 14-Dec. 13). No detections were recorded prior to spraying. Rainy season detections ranged from mean averages of 1.0 to 7.0 ppb whereas dry season detections were much lower and sometimes considered non-detects(below 0.1 ppb f detection). The table below summarizes dry and rainy season detection ranges and means for the six sample stations.

San Francisco Bay Estuary- Malathion Monitoring Results Dry and Rainy Seasons 1981

Station #	**Monitoring Dates**	**Mean Avg.**	**Range**
SF.1 Coyote Creek RR Bridge	7/20 to 9/24(dry season) 10/14 to 12/13(wet season)	0.1 1.7	0.0-0.25 0.0-5.3
SF. 2 Alviso Slough at South Bay	7/20 to 9/24(dry season) 10/14 to 12/13(wet season)	0.1 1.4	0.0-0.25 0.0-3.3
SF. 3 Guadalupe Slough at South Bay	7/20 to 9/24(dry season) 10/14 to 12/13(wet season)	0.1 1.7	0.0-0.40 0.0-3.5
SF. 4 Stevens Creek at South Bay	7/20 to 8/7(dry season) 11/3 to 12/13(wet season)	N.D. 1.0	N.D. 0.0-2.0
SF. 5 Palo Alto Yacht Harbor at buoy	7/20 to 8/7(dry season) No samples (wet season)	N.D. No samples	N.D. No samples
SF.6 Coyote Creek at Calaveras Pt.	7/20 to 8/7(dry season) 11/3 to 12/13	N.D. 1.0	N.D. 0.0-2.0
SF.7 Guadalupe Slough midway point	dry season-no samples 11/3 to 12/3	No samples 7.0	No samples 0.0 - 18.0
SF. 8 Alviso Slough midway point	dry season-no samples 11/3 to 12/13(wet season)	No samples 7.0	No samples 0.0-16.0

(Impact on Fish and Wildlife From Broad scale aerial Malathion Applications in San Francisco Bay Region, 1981, State of California Resources Agency, Dept. of Fish and Game , Environmental Services Branch, Administrative Report 82-2)

Office of Water - Red Book 1976 Jeff, G.
Malathion Sensitivity of Freshwater Fish (Salmonids (4), centrarchids (3)

* Mentions Estimated pH-6 half-life = 5 months. At pH-8 estimated half-life = 2 wks (Weiss and Gaksttatter, 1964)
*In Miami River monitoring 10% of original residues remained in Little Miami River (pH 7.3 - 8.0) after 2 wks (Eichelberger and Lichtenberg, 1971).

Environmental Monitoring Results of the Mediterranean Fruit Fly Eradication Program, Ventura County, 1994-1995. A.Bradley, P.Woolford, R.Gallavan, P.Lee, J. Troiano. State of California Environmental Protection Agency, Dept. Of Pesticide Regulation. EH-97-05, **December 1997.**

<u>Methods:</u> Air, soil surface and water residues were collected for analysis of malathion and malaoxon deposition levels following aerial application of malathion ULV and Nu-Lure bait mixture at an application rate of 102 gms malathion+ 789 ml of Nu-Lure per hectare. A 41 square kilometer area was dosed 14 times at night by helicopters flying at 130 km/hr 100 meters above the ground and equipped with 6 Tee Jet flat fan nozzles resulting in minimum swath width of 61 meters. Intervals ranged from 14 to 21 days between applications. Ground deposition to soil was recorded on 1 foot square absorbent material at 34 sites which were collected 30 minutes after application. Air samples where taken at 5 sites prior to, during and after applications were made. Water samples were collected at Conejo Creek at one site before entry of stream into the treated area and at a location where the stream exited the treatment area. These samples were stabilized by reducing pH to 3 by addition of hydrochloric acid. In addition, stream samples were collected following 3 heavy rainfall events on Nov. 7, Jan. 20, and March 21. These rainfalls occurred 3 to 12 days after the last application. Due to high readings of malathion residues in runoff after the first two rainfalls several additional sites further downstream and in an estuary 15 km away from the application area were sampled after the third event. In addition bioassays were performed on cladoceran and mysid species using stream samples following the Jan. 20 and March 21 events.
<u>Reported Results:</u> Deposition ranged from 80% (first 2 sprays) to 30% (third spray) of theoretically expected rate based on application rate computations. Ground deposition ranged from non-detectable to 0.07 mg/m2. The highest average air sample level recorded was 5.0 ppt (0.067 ug/m3) during the 24 hour period following a spray. Water samples collected at the inflow site for Callegus Creek befor application averaged 0.09 ppb of malathion and 0.04 ppb of malaoxon. Following application the outflow sample site malathion residues averaged 44 ppb (range=39-50 ppb). During the rainfall events the highest recorded level of malathion was 787 ppb and the highest malaoxon level was 160 ppb (12 days post application). The estuarine collection site (Mugu Lagoon) was sampled when a rainfall occurred six days after an application. The resulting residue concentrations were negligible during the storm, but rose to 11.2 ppb of malathion and 2.62 ppb of malaoxon 4.5 hours later. Fifteen hours later malathion had decreased to 0.16 ppb and malaoxon was not detected. No fish kills were reported, despite the high residue levels. However, bioassays performed with stream samples and *Ceriodaphnia*

dubia and with estuarine samples and *Neomysis mercedis* produced 100% mortality within 2 and 24 hours, respectively.

Appendix 5 Malathion EEC Crop Scenario Correlations

0.175 lb ai/acre
A10=Orange, Grapefruit, Lemon, Lime, Tangerine, Tangelo, and Kumquat

0.50 lb ai/A **B1**=Flax

0.61 lb ai/A
C5(5D)=Sweet Corn **C2(7D)**=Hops **C3(7D)**=Beans, Corn, Rice, Sorghum, Wheat, and Rye
C2(14D)=Alfalfa, Clover, Lespedenza, Lupine and Vetch

0.76 lb ai/A **D5**=Blueberry

0.94 lb ai/A
E1(3D)=Grass for hay **E4(3D)**=Mushroom **E6(6D)**=Strawberry **E3(7D)**=Peppermint and spearmint
E7(7D)=Macadamia

1.0 lb ai/A **F6(7D)**=Melons, Watermelon, Pumpkin and Winter Squash

1.25 lb ai/A
G1(3D)=Grass for hay **G2(3D)=Field corn** **G2(7D)** Brussel sprouts, cauliflower, collards, kale, kohlrabi
G6(3D)=Mustards **G25(3D)=Cotton** **G5(5D)=Watercress** **G3(7D)**=Rice, Sorghum, Wheat, Rye, Barley, Oats and Corn **G4(7D)**=Blueberry(ULV)
G5(7D)=Turnip, Broccoli, Apple, Sweet Corn, Beet, Chayote, Horseradish, Parsnip, Radish, Rutabaga, Salsify,
G6(7D)= Cabbage and Cherry(ULV) **G7(7D)=**Carrot **G8(7D)**=Mango **G12** Passion fruit
G9(7D)=Asparagus **G10(7D)**=Pears and Quince **G12(7D)**=Guava and Papaya **G2(14D)**=Alfalfa, Clover, Lupine, Vetch and Lespedenza

1.50 lb ai/A
H2(7D)=Celery **H6(7D)**=Okra

1.56 lb ai/A
I2(7D)=Potato and Sweet potato **I5(7D)**=Onion, Garlic, Shallot, Leeks

1.88 lb ai/A
J6(5D)=Lettuce **J4(7D)**=Blackberry, Raspberry, Loganberry, Boysenberry, Dewberry, Currant, Gooseberry
J3(7D)=Cucumber **J6(7D)**= Strawberry **J2(14D)**=Grapes

2.03 lb ai/A
K6(6D)=Strawberry(50%WP) **K3(7D)**= Spinach, Dandelion, Endive, Parsley and Swiss Chard
K4(7D)=Blackberry, Rasberry, Gooseberry, Loganberry, Dewberry, Currant and Boysenberry

2.5 lb ai/A
L25(3D)=Cotton **L3(5D)**=Figs **L3(7D)**=Mustards, Walnuts, and Pecans **L5(7D)**=Peas

3.43 lb ai/A
M5(5D)=Tomato, Pepper, Eggplant

3.75 lb ai/A
N4(7D)=Apricots **N6(7D)**=Cherry **N4(14D)**=Peach and Nectarine

4.70 lb ai/A
O2(30D)=Avocado

5.0 lb ai/A
P3(7D)=Pineapple **P4(7D)**=Chestnuts

6.25 lb ai/A **Q3(30D)**=Oranges, Grapefruit, Lemon, Lime, Tangerine and Tangelo

SAMPLE TERESTRIAL EEC OUTPUT FILES-MALATHION

RUN No. 1 FOR Malathion ON Sweet Corn *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.610(.813)	5 5	AERIAL_A	28.1	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
195.01(69.07)	89.38(29.25)	109.69(36.56)	12.19(5.69)

RUN No. 2 FOR Malathion ON Beans *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.610(.710)	3 7	AERIAL_A	28.1	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
170.44(60.36)	78.12(25.57)	95.87(31.96)	10.65(4.97)

RUN No. 3 FOR Malathion ON Alfalfa *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.610(.623)	2 14	AERIAL_A	28.1	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
149.42(52.92)	68.48(22.41)	84.05(28.02)	9.34(4.36)

RUN No. 4 FOR Malathion ON Blueberry *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.760(.811)	5 10	AERIAL_A	28.1	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
194.56(68.91)	89.17(29.18)	109.44(36.48)	12.16(5.67)

RUN No. 5 FOR Mushroom ON Malathion *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.940(1.605)	4	3	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
385.15(136.41)	176.53(57.77)	216.64(72.21)	24.07(11.23)

RUN No. 6 FOR Malathion ON Strawberry *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.940(1.160)	6	6	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
278.32(98.57)	127.56(41.75)	156.56(52.19)	17.40(8.12)

RUN No. 7 FOR Malathion ON Peppermint *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.940(1.094)	3	7	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
262.64(93.02)	120.38(39.40)	147.74(49.25)	16.42(7.66)

RUN No. 8 FOR Malathion ON Macadamia *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.940(1.098)	7	7	GROUND_A	.0	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
263.42(93.30)	120.74(39.51)	148.18(49.39)	16.46(7.68)

RUN No. 9 FOR Malathion ON Macadamia *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
.940(1.098)	7	7	AERIAL_B	16.4	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
263.42(93.30)	120.74(39.51)	148.18(49.39)	16.46(7.68)

RUN No. 10 FOR Malathion ON Melons/Squ *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.000(1.168)	6	7	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
280.24(99.25)	128.44(42.04)	157.63(52.54)	17.51(8.17)

RUN No. 11 FOR Malathion ON Corn *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.250(1.794)	2	3	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
430.58(152.50)	197.35(64.59)	242.20(80.73)	26.91(12.56)

RUN No. 12 FOR Malathion ON Mustards *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.250(2.198)	6	3	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

```
   SHORT       TALL        BROAD       SEED
   GRASS       GRASS       LEAF        FRUIT
   TEEC        TEEC        TEEC        TEEC
______________ ______________ ______________ _____________
527.62(186.87)  241.83( 79.14)  296.79( 98.93)  32.98( 15.39)
```

RUN No. 13 FOR Sorghum ON Malathion *INPUT VALUES*

```
--------------------------------------------------------------
RATE (#/AC)   APPLICATIONS   SPRAY   AVG PERCENT   INCORP?
 ONE(MULT)    NO.-INTERVAL   TYPE    SPRAY DRIFT   (%SURF)
--------------------------------------------------------------
1.250(  1.455)  3    7      GROUND_A      .9      NO(100%)
```

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

```
   SHORT       TALL        BROAD       SEED
   GRASS       GRASS       LEAF        FRUIT
   TEEC        TEEC        TEEC        TEEC
______________ ______________ ______________ _____________
349.26(123.70)  160.08( 52.39)  196.46( 65.49)  21.83( 10.19)
```

RUN No. 14 FOR Malathion ON Guava *INPUT VALUES*

```
--------------------------------------------------------------
RATE (#/AC)   APPLICATIONS   SPRAY   AVG PERCENT   INCORP?
 ONE(MULT)    NO.-INTERVAL   TYPE    SPRAY DRIFT   (%SURF)
--------------------------------------------------------------
1.250(  1.460)  12    7      GROUND_B      6.7      NO(100%)
```

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

```
   SHORT       TALL        BROAD       SEED
   GRASS       GRASS       LEAF        FRUIT
   TEEC        TEEC        TEEC        TEEC
______________ ______________ ______________ _____________
350.30(124.06)  160.55( 52.54)  197.04( 65.68)  21.89( 10.22)
```

RUN No. 15 FOR malathion ON carrot *INPUT VALUES*

```
--------------------------------------------------------------
RATE (#/AC)   APPLICATIONS   SPRAY   AVG PERCENT   INCORP?
 ONE(MULT)    NO.-INTERVAL   TYPE    SPRAY DRIFT   (%SURF)
--------------------------------------------------------------
1.250(  1.460)  7    7      GROUND_A      .9      NO(100%)
```

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

```
   SHORT       TALL        BROAD       SEED
   GRASS       GRASS       LEAF        FRUIT
   TEEC        TEEC        TEEC        TEEC
______________ ______________ ______________ _____________
350.30(124.06)  160.55( 52.54)  197.04( 65.68)  21.89( 10.22)
```

RUN No. 16 FOR malathion ON clover *INPUT VALUES*

```
--------------------------------------------------------------
RATE (#/AC)   APPLICATIONS   SPRAY   AVG PERCENT   INCORP?
 ONE(MULT)    NO.-INTERVAL   TYPE    SPRAY DRIFT   (%SURF)
--------------------------------------------------------------
1.250(  1.276)  2   14      GROUND_A      .9      NO(100%)
```

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
306.19(108.44)	140.33(45.93)	172.23(57.41)	19.14(8.93)

RUN No. 17 FOR malathion ON celery *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.500(1.746)	3	7	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
419.11(148.44)	192.09(62.87)	235.75(78.58)	26.19(12.22)

RUN No. 18 FOR malathion ON onion *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.560(1.821)	5	7	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
437.15(154.82)	200.36(65.57)	245.89(81.96)	27.32(12.75)

RUN No. 3 FOR malathion ON blackberry *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.880(2.194)	4	7	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
526.62(186.51)	241.37(78.99)	296.23(98.74)	32.91(15.36)

RUN No. 2 FOR malathion ON strawberry *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)

1.880(2.195) 6 7 GROUND_A .9 NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
526.84(186.59)	241.47(79.03)	296.35(98.78)	32.93(15.37)

RUN No. 3 FOR malathion ON grapes *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.880(1.919)	2	14	GROUND_B	6.7	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
460.50(163.09)	211.06(69.08)	259.03(86.34)	28.78(13.43)

RUN No. 4 FOR malathion ON rasberry *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
2.030(2.369)	4	7	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
568.64(201.39)	260.63(85.30)	319.86(106.62)	35.54(16.59)

RUN No. 5 FOR malathion ON figs *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
2.500(3.281)	3	5	GROUND_B	6.7	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
787.50(278.91)	360.94(118.13)	442.97(147.66)	49.22(22.97)

RUN No. 6 FOR malathion ON peas *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
2.500(2.919)	5	7	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
700.55(248.11)	321.09(105.08)	394.06(131.35)	43.78(20.43)

RUN No. 7 FOR malathion ON tomato *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
3.430(4.569)	5	5	GROUND_A	.9	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
******(388.35)	502.58(164.48)	616.80(205.60)	68.53(31.98)

RUN No. 8 FOR malathion ON cotton *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
1.250(2.213)	25	3	AERIAL_B	16.4	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
531.23(188.14)	243.48(79.68)	298.82(99.61)	33.20(15.49)

RUN No. 9 FOR malathion ON cotton *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SPRAY TYPE	AVG PERCENT SPRAY DRIFT	INCORP? (%SURF)
2.500(4.427)	25	3	AERIAL_B	16.4	NO(100%)

ON-FIELD FLETCHER RESIDUE LEVELS: MAXIMUM(TYPICAL) IN PPM

SHORT GRASS TEEC	TALL GRASS TEEC	BROAD LEAF TEEC	SEED FRUIT TEEC
******(376.29)	486.96(159.37)	597.64(199.21)	66.40(30.99)